

Multiscale Design Tool and Process Development of Thin-Ply Composites, Phase I

Completed Technology Project (2018 - 2019)



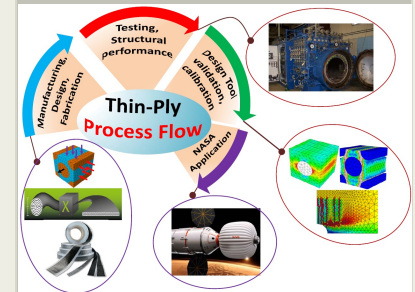
Project Introduction

Use of thin ply composites offers good potential for significant mass savings for aerospace structures besides its improved resistance to micro-cracking, fatigue, and delamination. However, mass savings due to thin-ply technology depends on material and fabrication technology, vehicle configuration, structural design, loads etc. Structural integrity of components made from thin plies need to be characterized over the service life considering the operational and environmental loads. Analysis packages are therefore needed to study how the thin ply manufacturing process parameters, part design and fabrication affect the properties and performance of the composite part over the service life. TDA, therefore, proposes to develop an integrated assessment tool for thin-ply composites including manufacturing process, material characterization and performance evaluation which results in improved design of aerospace structures. Our analysis methods and tools provide NASA and other industry users to evaluate, test numerous different carbon manufacturing technologies in order to cover all requirements as needed.

Anticipated Benefits

Thin Ply composites potential for use in NASA's applications arises from its higher fatigue and temperature cycling resistance, and superior capability in leak-tightness and micro cracking resistance. We foresee the immediate application of advances of our analysis tool to assess thin ply composites for use on pressurized structural systems such deep space habitation structures, and on reconnaissance aircraft, whether it is for integral tanks and other airframe structural parts.

We foresee use of thin ply composites in advanced components for the space, aeronautics, automotive, renewable energy and machine building industries. Our analysis methods and tools provide users to evaluate, test numerous different carbon manufacturing technologies in order to cover all requirements as needed. Our tools will allow users to accept product design and performance limitations due to manufacturing and procurement constraints.



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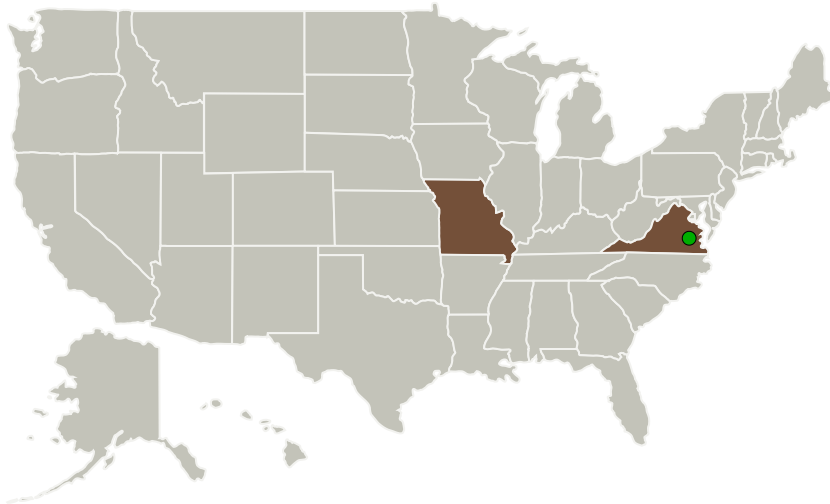
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Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
Technical Data Analysis, Inc.	Lead Organization	Industry	Falls Church, Virginia
● Langley Research Center (LaRC)	Supporting Organization	NASA Center	Hampton, Virginia
Missouri University of Science and Technology	Supporting Organization	Academia	Rolla, Missouri

Primary U.S. Work Locations

Missouri	Virginia
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Project Transitions

▶ **July 2018:** Project Start

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Technical Data Analysis, Inc.

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

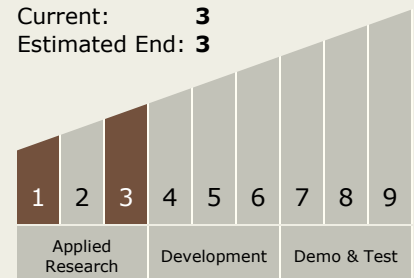
Carlos Torrez

Principal Investigator:

Mehdi Naderi

Technology Maturity (TRL)

Start: **1**
 Current: **3**
 Estimated End: **3**



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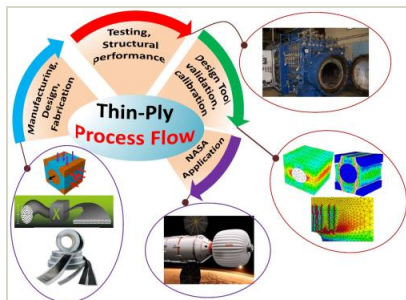


✓ **August 2019:** Closed out

Closeout Documentation:

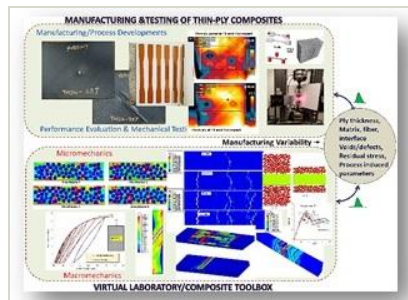
- Final Summary Chart(<https://techport.nasa.gov/file/137868>)

Images



Briefing Chart Image

Multiscale Design Tool and Process Development of Thin-Ply Composites, Phase I
(<https://techport.nasa.gov/image/127496>)



Final Summary Chart Image

Multiscale Design Tool and Process Development of Thin-Ply Composites, Phase I
(<https://techport.nasa.gov/image/131490>)

Technology Areas

Primary:

- TX12 Materials, Structures, Mechanical Systems, and Manufacturing
 - └ TX12.4 Manufacturing
 - └ TX12.4.1 Manufacturing Processes

Target Destinations

Earth, The Moon